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PISA scores from 2003 to 2012: A comparison of Turkey with the three countries which have been successful in each term in field of science

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Abstract

This study was conducted with a view to comparing Turkey with the most successful three countries of each term according to PISA science scores from 2003 to 2012. The study used document analysis as a qualitative research technique. The study revealed significant differences between Turkey and the countries examined in terms of economy, pre-school education, length of compulsory education, transition to secondary and higher education, teachers' education, decision-making power of teachers and in-service training.

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Keywords: PISA, science, Turkey

1. Introduction

PISA (Program for International Student Assessment) was developed by OECD in order to determine how efficiently the students at the 15 year-old age group are educated and trained in the face of the challenges of today's information society at the end of the compulsory education (MEB, 2014). The quality that PISA is in pursuit of measuring is not to what extent students learn the subjects under the curricula at schools, but their ability to use their

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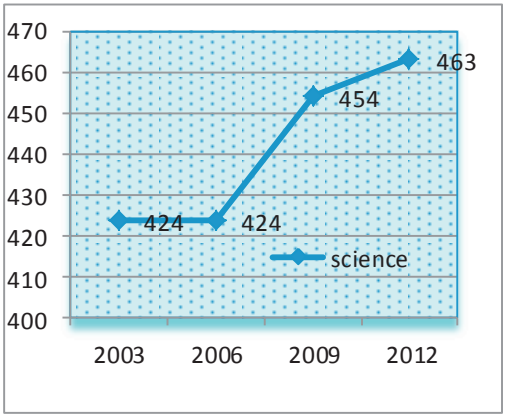
knowledge and skills under the circumstances they may encounter throughout their lives. The PISA Project covers three main fields such as mathematics, science and reading skills. Furthermore, PISA also measures problem solving skills in relation to these three main fields (NCES, 2012). The PISA Project, which is applied in three-year terms, gives weight to a field of subject at every individual term.

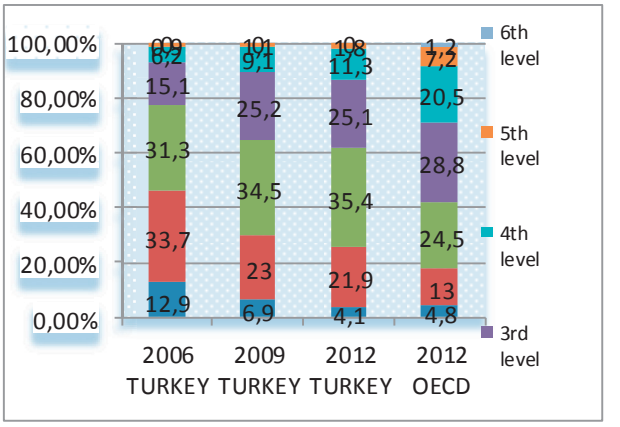
The PISA Second Cycle Project, which Turkey participated in, too, covered the years between 2000 and 2003. In this term, the weighed field of subject was mathematics while students were also measured for their knowledge and skills in science, reading and problem-solving. 41 countries, including Turkey, participated in this project. Thirty countries were OECD members whereas the other eleven countries were non-members. Turkey ranked in the 28th position with a score of 424 points in science in 2003. Although this score was regrettable for Turkey, it turned into positive as it led to initiate a process towards making radical reforms in the education system. A new education system based on a constructivist approach that was put into practice gradually in the educational year of 2005-2006 has replaced the old education system based on a behavioural approach that had reigned for many years. After such developments, Turkey has started to take PISA examinations regularly.

For the purpose of this study, one can find here information about situation of Turkey only in field science under the PISA Project. Figure 1 shows the scores of Turkey in the field of science in the PISA examinations that Turkey took and Figure 2 displays the break-down of students by science competence levels in PISA examinations between the years of 2006 and 2012.



Note: Works of MEB (2010, a), MEB (2010, b) and MEB (2013) were cited when making the Figure 1.

Figure 1. Science scores of Turkey in PISA



Note: Works of MEB (2010, a), MEB (2010, b) and MEB (2013) were cited when making the Figure 2.

Figure 2. Breakdown of students by science competence levels in PISA examinations between the years of 2006 and 2012

According to Figure 1, the scores were similar between the years of 2003 and 2006 whereas there was an increase of 30 points during the 2006-2009 period. Although this increase was the largest one among OECD members, Turkey performed far below the OECD average at every term. A significant increase has not been observed in the scores of the period of 2009-2012 when compared to the previous period. Figure 2 points to the percentage of students who are below the level 2 corresponding to basic skills. It points out that almost half of Turkish children at age of 15 do not have basic skills according to the 2006 scores. In 2009 and 2012, this percentage displayed a tendency of gradual decrease. From 2006 to 2012, percentage of students at and under level 1 decreased while the percentage of students at and over level 2 has increased. Particularly in the transition between 2006 and 2009, the decrease of the percentage of students at and under level 1 supports the increase of 30 points in Figure 1. Nevertheless, the percentage of students who performed outstandingly by receiving points corresponding to level 5 in Turkey is sizably lower than the OECD averages. It is a pity that Turkey had no student who performed at level 6.

Although the low scores in the PISA examination in 2003 were explained by our education system based on a

behavioural approach, controversies arose in educational circles because the scores after 2003 could not bring a smile on faces either. Considering that it would shed some light on this debate, this study was conducted with a view to comparing Turkey with the most successful three countries according to PISA physical science scores from 2003 to 2012.

2. Method

This study used document analysis as a qualitative research design. At the data collection phase, we have examined the physical sciences scores of PISA examinations from 2003 to 2012. To this aim, three most successful countries were analyzed. These countries were found to be Finland, Canada, Japan, Estonia, China (Hong-Kong and Shanghai) and Singapore. China was examined as a whole because there was not any elaborated information about Hong-Kong and Shanghai. Under the light of the information obtained at the data collection phase, a table was established about countries for a more facilitated comparison.

3. Findings

Table 1 gives us general information regarding economies, education and teachers' education systems of Turkey and three countries that were the most successful at every term in PISA science examination.

Table 1: Economies education and teachers' education systems of countries

Attributes / Country	ECONOMY	PRE-SCHOOL	PRIMARY EDUCATION	SECONDARY EDUCATION	HIGHER EDUCATION	EDUCATION OF TEACHERS
TURKEY	**GDP:** USD 560 billion **Income per capita: $15.001**	It is not compulsory. However, preschool education is encouraged and promoted by government and relevant authorities.	There is a 4+4+4 year gradual compulsory education. Children go to primary school as they are 66 months old. . The first 4 years are primary school while the second 4 years cover secondary school. There is a national curriculum. Course books are selected by Ministry of National Education.	Secondary education (high school education): Transition to the high school is at the end of the 8th grade (the 4th year of the secondary school) via the Examination of Transition from Basic Education to Secondary Education (TEOG). Secondary education covers all general, vocational and technical education institutes that render a four-year compulsory, formal or informal education after the basic education. Graduates of these schools receive a high school degree.	Those who graduate from high school or equivalent schools must pass a national examination in order to go to higher education institutes. Higher education covers education institutes that render at least two-year higher education after high school.	Students must pass the national examination made after secondary education in order to enter a teachers' education institute. To be a teacher requires graduation from a four-year faculty of education or a faculty of science or letters as well as getting the required scores in the Civil Servants Selection Examination. Ministry of National Education is in charge of in-service training.

FINLAND	**GDP: $** 250 billion **Income per capita: $34,585**	Since 2001, all children at age of 6 are entitled to preschool education free of charge. In 2002, 98% of 6 year-old children attended preschool education.	Children must start compulsory primary education in the year when they finish their 7th age. Compulsory education is for 9 years.Course books and curricula are determined by schools themselves.	Students who successfully graduate from compulsory education are eligible for general and vocational education and training. Applications to secondary education are through a national application system.	Higher education is rendered in universities or vocational collages that are higher education institutes for a professional life. Both have their own profiles.	Each institute of education of teachers has their own examinations. Teacher who work in the first six years of basic education teach all subjects in general (classroom teachers) while subject teachers work in the last three years and the second phase of secondary education. Classroom teachers have a master's degree on Education while subject teachers have a master's degree not only on pedagogical subjects but also on their field of speciality.
CANADA	**GDP: USD** 1,821 trillion **Income per capita: $39,057**	Licensed baby-sitters and nurseries render basic and social education to children younger than five years old. Children start to go to kindergarten when they turn in five years old.In many states, preschool education is mandatory.	Although the age for compulsory education varies from one state to another, in general it starts at the age of 5-7 and finishes at the age of 16-18.Primary school is from the 1st grade to the 6th or 8th grades. It varies from one region to another. If a student fails, he/she must repeat the class.States, local administrations, school regions and school boards are very influential in structuring the educational system. The curricula vary from one state to another.	Vocational or academic education is rendered.Students can be classified according to their skills.Curriculum is rather heavy and there are compulsory subjects.	Higher education institutes include universities, colleges and the institutes that are opened by different educational institutes. Administration of these higher education institutes is under the legal responsibility of states or regions. In Canada, students must take many required courses. It is about not only specialization in one single subject but	There are two models in education of teachers: undergraduate and graduate degrees. Teachers of secondary education must have a license degree.In-service training is important. In-service training is under the responsibility of Ministry of Education, Universities, School Boards and Teachers' Union.

					being well-furnished in many subjects.	
ESTONIA	**GDP:** USD 21,85 billion USD **Income per capita: $16,880**	It covers children at the age group of 1-6 years.It is not compulsory. It is funded by local and special administrations. Moreover, government and families contribute in funding.	Basic education is compulsory at level 1.Education is for 9 years and level 1 is composed of primary and secondary schools.Education is free of charge at state and local basic education institutes.Each school prepares its own curriculum in line with the basic national curriculum.Teachers select the course books by themselves. Students must pass three exams to complete the level 1.	Phase 2 general education is not compulsory. The second phase of secondary education covers a 3-year education. Schools at this phase prepare their own curricula by themselves in accordance with the national one. The number of students in classrooms is 36 in average. Students should pass five graduation examination in order to complete the second phase .	Higher education system is composed of universities that render academic and vocational education as well as vocational collages that have vocational higher education curricula. Higher education institutes are autonomous. Thus, each higher education institute can define their special terms and conditions.	In general, teachers have higher education degrees. Education of teachers at universities is composed of general educational science, psychology, art of teaching and practical trainings. Education of teachers is at undergraduate and graduate levels. (ERYDICE, 2007) In-service training is important.
JAPAN	**GDP:** USD 5,96 trillion **Income per capita: $45,774**	Preschool education is given at kindergartens and day-care centres. Children do not fail a class in kindergartens.	Primary education is composed of primary schools for 6-12 year-old children and secondary schools for 12-15 year-old children and it is compulsory.	These are the educational institutes where graduates of primary and secondary schools attend. There are three types of high schools in Japan: Full time, part time and correspondence high schools.	There are three types of higher education institutes in Japan: Universities, colleges and technical schools.	Candidate teachers apply to the Regional Board of Education to be a teacher. Director of Education asks for the opinion of the principal of the relevant school, and the principal conveys his/her opinion. Board of education invites candidates to a written examination. Candidates who pass the written exam are invited to an interview. Successful candidates are appointed as candidate teachers. Those who complete

						the six-month candidacy period quality to be a civil servant. In-service training is important. Ministry of Education, Regional and Local Education Units, Schools and the staff are responsible for in-service training.
CHINA	**GDP:** USD 9,020,3 trillion **Income per capita: $ 1,926**	They just provide special care for children without any academic curriculum. Furthermore, any child older than 36 months can go to kindergartens which are in the official education system.	Children start to go to school at age of 7 and according to the "Compulsory Education Act" primary school is for 6 years (still 5 years in some regions) and secondary school is for 3 years. Primary education is for 9 years in total. There are two types of schools.	Students who graduate from nine-year compulsory education attend high schools for three years. The system is configured as 6+3+3 years and 5+4+3 years. Private secondary education institutes are for two, three and four years, and their durations and entrance terms depend on their curricula.	In China, there is a higher education system that contains almost all fields in many levels and forms. However, many young people are still deprived of a chance to go to a university.	Primary school teachers are educated at vocational high schools where they study the regular courses and vocational courses together. Teachers of secondary schools are educated at 2 or 3-year vocational institutes after high school. In-service training is important. Every teacher must receive in-service training for certain amount of hours specified by the Government.
SINGAPORE	**GDP:** 324,6 billion SAGP dollars **Income per capita: $51.709,45**	Kindergartens provide three-year education for children from 3 to 6 years old and they are not compulsory. Nurseries also provide kindergarten education for children at age of 3-	In primary education institutes, education is compulsory for 6 years. The first 4 years is the basic stage while the last two years are for professional guidance. At the end of grade 4, students are grouped according to their scores in the primary school leaving exam measuring their English, mathematics and native language	Secondary education institutes render education for four or five years. It is compulsory and free of charge. Students have three choices based on their learning skills and areas of interest: special, fast and regular (academic or technical). Students are placed in high schools according to their score in primary school leaving exam.	It is composed of two or three-year associate collages as well as polytechnic and technical universities or institutes. These schools enrol students according to their scores in the secondary education graduation examination.	When students are accepted in to pre-service education and training programmes, the number of teachers needed is taken into consideration and quotas are determined accordingly.Therefore, students are often employed directly after graduating from these programs. Students must take a written examination and an interview where they are measured for their teaching skills (sample lecturing) as well as

	6 years.	skills and knowledge (PSLE=primary school leaving examination). Parents have right to a word at the final grade while decision-maker is the principal of the school at grade 5 and 6. At the end of grade 6, students take primary school graduation exam.	their interest and aptitude for the profession and their communication skills. In general, students accepted to the program receive the education free of charge and even they are paid. In-service training is important.

Note: Works of Balcı (2009), Aydoğan (2008), Özoğlu, Gür and Altunoğlu (2013), Eurydice (2008) and Erginer (2007) were cited when making the table.

As we analyze the economies and income per capita of countries in Table 1, we can see that all countries in the table except China have a higher income when compared to Turkey. We also observe that, in all countries including Turkey, preschool education is not compulsory. The length of primary education varies from 9 to 12 years. In all countries examined, there is a two-tier compulsory education whereas compulsory education is 4+4+4 years in Turkey. Considering the secondary education, in Turkey there is an examination for transition to secondary education while other countries make a secondary school graduation examination. Turkey makes a national examination for university entrance and uses the score of this examination to place students in departments of universities. In other countries, there is generally a high school graduation examination and each university has a specific examination for itself. Especially in education of teachers, there are great differences between Turkey and other countries. In Turkey, teachers' education institutes accept students only according to their scores in the university entrance examination whereas all other countries have additional examinations. Successful countries mostly require a four-year undergraduate degree for primary school teachers and a graduate degree for secondary school teachers. Considering in-service training, each country has its own in-service training practice while there are differences in units rendering in-service training and the content of in-service training.

4. Discussion

Findings of the study have shown that successful countries are mostly strong in socioeconomic terms. Although national income levels of countries do not have a definite impact on educational quality, educational qualities and outputs may have a direct impact on economic performance of a country. According to the PISA scores, we observe a correlation between the successful performance of countries in PISA and economic growth and development of the countries (ERG, 2010; Acar, 2012). Although we take into consideration that the national income level of Turkey is low, scores of Turkey in PISA examinations are still far from the expectations (ERG, 2010). The score difference between students in the lowest and highest socioeconomic quarters is too high (92 points according to the 2009 scores) (ERG, 2010), which displays the correlation between socioeconomic status and education. As we examine the countries in Cluster 3 such as Finland, Hong-Kong, China, Japan and etc. in the clustering analysis according to the 2009 PISA scores, we see that the countries in this cluster have equality of opportunity, qualified teachers and direction of students according to their skills in their educational systems (Acar, 2012; Çobanoğlu and Kasap, 2010). On the other hand, as we analyzed the countries in Cluster 1 where you can also find Turkey, the most striking aspect is the share that these countries allocate to national education out of the general budget. Accordingly, one of the improvements Turkey needs to carry out in order to perform successfully in international examinations like PISA is to reach up to EU averages in terms of socio-economic figures (Acar, 2012).

When we examine the successful countries, we observe the great importance attached to preschool education in these countries. Preschool education is one of the most important tools to cope with the decisiveness of socio-economic level. However, the PISA scores show that preschool education does not fully utilize such a tool in Turkey (ERG, 2010). It is a pleasing fact that the Government in Turkey has been attaching more importance to preschool education in recent years. Primary education is compulsory in all countries. However, we can observe differences in the length of compulsory primary education. The model of 4+4+4 years has been controversial in Turkey. In particular, many circles have strongly reacted against the condition of completing 66 months to start primary school. In other countries, primary school starting age is 6 or 7 except in some states of Canada.

Although there are national examinations in each country for transition from primary to secondary education, the purposes of these examinations are different from one another. In Turkey, these examinations are used for placing students in secondary education institutes whereas they are made in all other countries to graduate from primary education. It is also the case in transition to higher education institutes. In Turkey, students are placed in to departments of universities according to their scores from the national university entrance examination while these examinations are made in other countries to finish high school and each university has its own examinations when selecting the students to enrol, which points out that students who will go to a university carry attributes that are specific and appropriate to the department where they will study. In other words, there are professional practices in all those countries right to the purpose unlike the ones in Turkey where students select their university department merely according to their scores in the examination.

One of the success factors of all these countries examined is perhaps the way they educate and develop their teachers. In these countries, institutes that educate and train teachers after secondary education make specific examinations in addition to the general examination. These specific examinations include interviews and sample lecturing to measure academic knowledge as well as the interest and aptitude for teaching profession and communication skills of candidates. Countries such as Finland and Singapore take into consideration the number of teachers needed when accepting students in to higher education institutes and they only accept students as many as they need, which facilitates direct employment of candidate teachers who graduate from the teachers' education departments (Özoğlu, Gür & Altunoğlu, 2013). However, in Turkey, the need for teachers is not taken into account and placement of students in to education departments of universities depends merely on the examination scores, which results in many problems. First of all, the system does not care about whether a candidate who is accepted to the education department bears the attributes and characteristics required for teaching profession. It leads to problems about education and development of quality teachers. Secondly, since the need for teachers is overlooked, there are pilings in education departments of universities and it cannot be possible for every graduate to be employed. Any graduate must take an examination called as "the civil servants selection examination" (KPSS) which consists of educational sciences, general knowledge and an additional field examination introduced two years ago. Candidates who get the required score in this examination are directly appointed as teachers without any further condition. Another important aspect in education of teachers is the quality of trainers of candidate teachers. According to the Eurydice (2006), in Europe including Finland and Estonia, trainers' standards have been set to educate and train candidate science teachers at schools. According to these standards, trainers of candidate teachers must have a PhD degree in physical sciences and must be well-experienced in educational research. The trainers who will serve as a mentor for candidate teachers in practices must have at least five-year experience. Despite such a professional approach to education of teachers, it is obvious that the quality of the staff tenured in education faculties in Turkey is highly questionable. Özoğlu, Gür and Altunoğlu (2013) emphasized two important aspects about education of teachers. First, due to giving education to too many teachers, there are pilings in pre-service programs and we encounter very serious problems to find both qualified trainers for candidate teachers and schools for practical education that are indispensible for translation of theory into practice. Secondly, in addition to all these problems, profession of teaching has started to lose its attraction in recent years in Turkey. There is a strong relationship between respectability of a profession and its social status. Professions with a higher status will be preferred by more people and there will thus be a higher chance to select the most successful ones. Since it is the Ministry of National Education who specifies what teachers will do and how they will do it, it is very difficult to speak of autonomy. In Turkey, due to all these problems listed, we observe significant decrease in base points and there are serious changes in the profiles of students who prefer this profession. However, the teacher profile in the

successful countries is fairly different from that in Turkey. For instance, in countries such as Finland and Estonia, school-teaching is a very respectable profession, which is easily observed in social status and income levels of teachers as well as the vast powers and authorities given to teachers in decision making processes about educational issues such as school policies, selection of course books and formulation of the curriculum (Özoğlu, Gür & Altunoğlu, 2013; Eurydice, 2008).

Another important aspect of successful countries is the importance attached to in-service training. These countries take significant steps to ensure professional development of teachers. For instance, Chinese Ministry of Education required primary and secondary school teachers to receive at least 240 hours of in-service training in a period of five years in 1999 for professional development of teachers. China thus updated its curriculum and facilitated professional development of teachers. Finland is another country who attaches great importance to in-service training. What makes Finland different is that in-service trainings are determined by the school themselves. In Turkey, these programs are regulated centrally (Özoğlu, Gür & Altunoğlu, 2013). Ministry of National Education is responsible for development of educational staff in Turkey. Nevertheless, the central structure of the ministry restrains the in-service training activities from achieving up to desired levels (Aydoğan, 2008). For example, in a study conducted with Turkish teachers, teachers stated that they deemed insufficient the in-service training program rendered by the ministry, the mandatory participation condition was a problem and trainers who render these trainings were not qualified enough (Çelik, 2012). In another study conducted with teachers, teachers stated that barriers such as there are not motivating elements to carry out activities for professional development, there are not so many activities for professional development at schools, they were not asked for their opinions in selection of in-service training subjects and they are not free to select the program they want to take part and etc. hindered their professional developments and in-service trainings (Özer, 2004).

5. Conclusion and Recommendations

This study was conducted with a view to comparing Turkey with the most successful three countries of each term according to PISA physical science scores from 2003 to 2012 in field of physical sciences. The study used document analysis as a qualitative research technique. The study revealed significant differences between Turkey and the countries examined in terms of economy, pre-school education, length of compulsory education, transition to secondary and higher education, teachers' education, decision-making power of teachers and in-service training. We can recommend the followings in the light of findings of the study:

- Pre-school education should be attached more importance.
- 4+4+4 year education system should be revised.
- Serious reforms are highly needed in education of teachers. First, the number of students to be accepted in education faculties should be determined in line with the needs. Secondly, as is the case in other countries, additional examinations specific to the profession should be made when students enter in education departments.
- Teachers should be allowed to be directly involved in educational issues such as formulation of curriculum and selection of course books.
- In-service training programs of successful countries should be analyzed and in-service training activities in Turkey should be more professional.
- As directly related with all the above-listed issues, budget of education should be increased.

References

Acar, T. (2012). Türkiye'nin PISA 2009 sonuçlarına göre OECD'ye üye ve aday ülkeler arasındaki yeri. *Kuram ve Uygulamada Eğitim Bilimleri, 12(4)*,2561-2572.

Aydoğan, İ. (2008). Çeşitli Ülkelerde Eğitim Personelini Geliştirme Faaliyetleri ve Bir model önerisi. *KKTC Milli Eğitim Dergisi, 2*.

Balcı, A. (2009). *Karşılaştırmalı Eğitim Sistemleri*. Ankara: PegemA.

Çelik, Z. (2012). *Politika ve uygulama bağlamındaTürk eğitim sisteminde yaşanan dönüşümler: 2004 ilköğretim müfredat reform örneği*. Yayımlanmamış Doktora Tezi, Hacettepe Üniversitesi, Ankara.

Çobanoğlu, R. & Kasapoğlu, K. (2010). PISA'da Fin Başarısının nedenleri ve nasılları. *Hacettepe Üniiversitesi Eğitim Fakültesi Dergisi, 39,* 121-131.

ERG (2010). *PISA 2009 Sonuçlarına İlişkin Değerlendirme*. Retrieved on June 20, 2014 from www.erg.sabanciuniv.edu

Erginer, A. (2007). *Avrupa Birliği eğitim sistemleri: Türkiye eğitim sistemiyle karşılaştırmalar*. PegemA Yayıncılık, Ankara.
Eurydice (2008). *Avrupa'daki Öğretmenlerin Sorumluluk ve Özerklik Düzeyleri*. Avrupa Komisyonu, Eurydice Avrupa Birimi.
Eurydice (2006). *Avrupa Okullarında Fen Bilgisi Öğretimi Politikalar ve Araştırmalar*. Avrupa Komisyonu, Eurydice Avrupa Birimi.
MEB (2010, a). *PISA 2009 Ulusal Ön Rapor.* Milli Eğitim Bakanlığı, Eğitimi Araştırma ve Geliştirme Daire Başkanlığı, Ankara.
MEB (2010, b*). PISA 2006 Projesi Ulusal Nihai Raporu*. Milli Eğitim Bakanlığı, Eğitimi Araştırma ve Geliştirme Daire Başkanlığı.
MEB (2013). *PISA 2012 Projesi Ulusal Ön Raporu.* Retrieved on June 20, 2014 from www.http://pisa.meb.gov.tr
MEB (2014). *PISA nedir?*.pisa.meb.gov.tr/*page_id=18 adresinden 06.07.2014 tarihinde alınmıştır.
NCES (2012). *Program for international students assessment (PISA*). Retrieved on July 06, 2014 from Nces.ed.gov/surveys/pisa/
Özer, B.(2004). *Öğretmenlerin Hizmetiçi Eğitimi: Katılma Durumları, Beklentileri ve Engelleri.* Paper presented at XIII. Ulusal Eğitim Bilimleri Kurultayı.6-9 Temmuz 2004, İnönü Üniversitesi, Malatya.
Özoğlu, M., Gür, B.S. & Altunoğlu, A. (2013). *Türkiye'de ve dünyada öğretmenlik retorik ve pratik.* Eğitimciler Birliği Sendikası, Eğitim Bir-sen Yayınları 54, Araştırma dizizsi 10. Retrieved on July 06, 2014 from http://www.egitimbirsen.org.tr/ebs_files/files/yayinlarimiz/252-egitimbirsen.org.tr-252.pdf